United States Mint, Philadelphia, Penn.,

MELTER AND REFINER'S DEPARTMENT,

2nd May, 1879.

Hon. A.L. Snowden
Superintendent
Sir,

Being charged with a weekly discussion of the wastages that occur in melting Deposits, and with advice in the mode of melting them, I respectfully submit to you a few thoughts & some suggestions that occur to me in executing my duty, and on which your own former experience will enable you to form a more ready opinion.

The first object in melting deposits of bullion, is to bring them (each separately) to such a uniform interpenetration of their contained metals, that the weight & assay of a small piece of each will allow a correct calculation of the value of the whole of each deposit. This is effected by melting the deposit alone, or under a charcoal cover, or with such and so much flux, as will remove adhering impurities of stone, iron, &c., and then

then to make the remaining metal or alloy, uniform in composition throughout, by thorough stirring, just before casting, whether casting the whole deposit, if small, or casting first a granulation, if it be a large silver deposit. The nature of the fluxing should depend on the experience of the Melting foreman, acting under the advice of the Melter & Refiner.

The second object involves a fundamental principle, influencing the mode of melting, viz. that neither the Depositor nor the Government should suffer undue loss of precious metal. If the deposit be melted with the least loss in weight, by rigid watchfulness of the melter, the depositor would plainly suffer no loss, but if, in such a case, so much volatilizing matter is left, that, when the deposit is passed over and debited to the Government, and it is again melted, - a portion of precious metal is unavoidably lost by the simple act of melting & the loss falls on the Government, because the Depositor has been paid for all the valuable metal that was in his deposit, when passed over, & yet the Government cannot get out of the deposit all that was in it. The Deposit

Deposit-Melting Room should be the guardian of the interests of the Depositor & the Government.

The experienced receiver of Deposits can generally form an approximate estimate of the quality of a deposit so far as to indicate the best mode of melting, but there are deposits of both Gold & Silver bars, whose origin & therefore composition are unknown, and unfortunately whose good color and neat appearance conceal the tempted cupidity of people to develop the resemblance of good metal by pickling. The largest experience in melting is at fault in judging of probable loss of weight in melting such bars.

Loss of weight in melting. There is one point of view in which such loss demands consideration, viz. the apparent loss in valuable metal, as it seems, to the ignorant depositor, who will of course assume that loss of weight means loss of precious metal, & indicates wrong doing by the Government or its officers.

If loss in melting occur, as it almost always does, it does not necessarily involve a proportionate loss of precious

precious metal, nor even any of it, but on the other hand the remarkable stability of Gold & Silver in the fire, and their slight liability to be seized by fluxes, confirm the experience, that nearly all cases of loss in melting consist in the removal of base metal, copper, lead, &c., with little or no precious metal. In other words the metal becomes refined by being separated from its grosser companions, shows a higher standard of fineness, without loss of the precious metal.

Where the accompanying metal is volatile, such as zinc, then the absolute loss of some precious metal is certain, & is measurably proportional to the percentage of the volatilizing metal, which it accompanies in its flight; and unhappily zinc forms too convenient alloys, not to employ brass to dilute Gold without impairing some of its external characters.

To meet the cavil of depositors, as well as to know the truth of loss of precious metal, would it not be advisable to make the course, we have exceptionally followed with doubtful deposits, a rigid rule, — to reserve a small assay slip of a deposit, taken before melting by ourselves, to test the original

original content of gold & silver, if required, so as to compare it with the content after melting, & so meet cavil by fact.

There are several points growing out of the preceding remarks, which I here present.

1. The first & essential point is to render a deposit uniform, & to do this, it is sometimes found necessary to melt it a second, & in rarer cases a third time, before getting a representative assay. If this be done judiciously & yet loss of valuable metal occur, it ought manifestly to fall on the depositor, because the nature of the deposit & not the Government is responsible for the loss.

2. When a base, but stable metal, like copper, is present, the deposit may be melted under a charcoal cover, or to get a cleaner bar, a little borax, with or without a little soda, is used, & in this case the small loss will be wholly due to the copper seized by the flux.

3. When the more fusible metals, such as lead, are present, beside copper, it is advisable to use a little nitre to oxidize the fusible and baser metals, & catch them by a little sand or bone-ash thickening the floating flux, so that it may be skimmed off.

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4 When the volatilizing metals bismuth, antimony, zinc, or arsenic are present, it seems but reasonable that the larger portion of these should be removed from the deposit before debiting the Government with the weight, because, if a sensible quantity of them remain, when so charged, the first melting by the Government will throw off some valuable metal, so that the Govt will be charged with Gold or Silver, which it did not & could not get out of the deposit. Since the fault rests in the nature of the deposit, the depositor should bear the loss. Such deposits should be melted in a manner similar to the 3rd class, by oxidation with nitre, which must however be liberally used, & always in the presence of a little soda-ash, thickening the flux after the action of the nitre has ceased, with sand or bone-ash, or even (& sometimes preferably) with lime.

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Opinion on deposits before melting. Since this judgment is of some consequence, in order to give the required opinion on the proper amount of loss in melting, I offer one or two suggestions for consideration. Fortunately the experienced eye can judge safely & fairly of the large majority of deposits, but a few present difficulties, which have not yet been overcome, & which I desire specially to meet.

1. In case of doubtful bars, we ought to make it an invariable rule to cut & break them, if practicable, because the appearance of the cut or break, reveals much of the hardness or softness of the metal. This is frequently done

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2. I have thought that a test by drops of acid on the cut surface would tell the Assayer something more in reference to the composition of the deposit than the most experienced eye alone could possibly give. I can even conceive of a moderate series of alloys of known composition, representing in substance those known to occur in jewelry, dentistry, & other manufacturing operations, which could be used for comparative tests with deposits.

3. A third method would be a little more consumptive of time & labor, but yet its value might warrant its use. It is to take the specific gravity of a piece of a deposit, & by comparison with the Spec. Gravities of the alloys mentioned in the preceding paragraph, to form often a very safe judgment of composition, & consequent degree of loss on melting

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the melted state, & its weight before & after melting, together with accompanying phenomena, might form the basis of a sound judgment on the probable amount of loss, as well as of the causes of such loss.

I do not wish to accumulate needless labor in any department of the Mint, but it seems to me that some one from the Assay Dep't might legitimately be charged with such preliminary testing with acid, fire, & balance on assay slips of a deposit.

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Very respectfully yours,

Ja H Booth,

M. & R.

210½

U. S. Mint, Melter and Refiner's Department,

PHILADELPHIA, PENN.,

May 2, 1879.

Jas. C. Booth

Melter and Refiner.

Detailed Report on Deposit Meltings & the proper means of verifying losses.

No. of Enclosures,

Rec'd May 2nd 1879.

NARA RG104, Entry 1, Box 116

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